EPA Research on Next Generation Emissions Measurement

EPA's Office of Research and Development (ORD) Next Generation Emissions Measurement (NGEM) research team is working collaboratively with industry, state and local air agencies, communities and technology companies to develop innovative technical approaches for detecting and reducing emissions of volatile organic compounds (VOCs) and other pollutants from industrial fugitive and area sources. This research is focused on improving the understanding of complex air pollution sources including fugitive leaks, waste ponds, and process malfunctions by advancing lower-cost and portable air measurement technology. This technology is providing mobile and stationary, real-time measurement capabilities. The different types of sources (e.g., oil and gas facilities, refineries, landfills, industrial chemical facilities) vary tremendously and the approaches/techniques to evaluate the emissions vary, as well.

A June 2020 EPA Science Matters summarizes *Innovation in Air Quality Monitoring*. Specifically, pages 16-17 provide highlights of NGEM-related research activities. Below are highlights of some recent/ongoing work led by EPA that may be of interest. EPA scientists would be happy to meet with interested states to discuss this work in more detail.

- At a project initiated in 2017 in Louisville, Kentucky, EPA researchers deployed prototype Sensor Pods, or SPods, in the Rubbertown industrial district where poor air quality and odor issues have been raised by local neighborhoods. The SPod is a commercially available, solar-powered sensor system that is portable, lower-cost, and can be placed at a facility's fenceline. It measures total VOCs and can be placed along the perimeter of a facility to detect leaks that can result in plumes of pollutants moving into nearby communities. Information about the Rubbertown project can be found on LouisvilleKy.gov webpage, on EPA's webpage, in the attached poster at the 2019 American Geophysical Union annual conference (titled *Low-cost Sensor Applications for Improved Control of Fugitive Industrial Emissions*) and in the attached peer-reviewed journal articles:
    - Thoma et al. 2019. Rubbertown Next Generation Emissions Measurement Demonstration Project. Int. J. Environ. Res. Public Health 16, 2041. https://doi.org/10.3390/ijerph16112041

    - Mukerjee et al. 2020. Spatial analysis of volatile organic compounds using passive samplers in the Rubbertown industrial area of Louisville, Kentucky, USA. Atmospheric Pollution Research 11 (2020) 81–86. https://doi.org/10.1016/j.apr.2020.02.021

- An EPA ORD Cooperative Research and Development Agreement (CRADA) with Flint Hills Resources, a refinery operator, and Molex, a sensor company, is developing and testing an in-facility leak detection sensor network NGEM system. Following prototype testing, long-term pilot projects in multiple refinery process units in Texas were successfully conducted. An EPA report summarizing the CRADA will be published in early 2021. The approach is currently being considered by regulators as a potential site-specific alternative to manual leak detection. A recent presentation describing the technology is attached:
    - Peng, et al. 2019. An Automated Sensor Network System and Innovative Approach for VOC Leak Detection. American Fuel and Petrochemical Association Environmental Conference, Oct. 27-29, 2019, Salt Lake City, UT, U.S. EPA Science Inventory, https://cfpub.epa.gov/si/, record 348039, https://cfpub.epa.gov/si/si_public_file_download.cfm?p_download_id=539686&Lab=CEMM

- Optical gas imaging (OGI) is a commonly utilized leak detection method. EPA is exploring OGI and supporting emissions measurement methods to evaluate potential maintenance issues resulting in increased air emissions. This research was recently presented in two journal articles: 1) evaluating the detection efficacy of OGI surveyors, using their own cameras and protocols, with controlled

releases in an 8-acre outdoor facility that closely resembles upstream natural gas field operations and 2) evaluating a novel survey approach of pneumatic controllers at oil and natural gas production facilities in the Denver-Julesburg basin.

- o Stovern et al. 2020. Understanding oil and gas pneumatic controllers in the Denver-Julesburg basin using optical gas imaging. Journal of the Air & Waste Management Association, 70:4, 468-480. https://doi.org/10.1080/10962247.2020.1735576
- o Zimmerle et al. 2020. Detection Limits of Optical Gas Imaging for Natural Gas Leak Detection in Realistic Controlled Conditions. Environ. Sci. Technol. 2020, 54, 18, 11506–11514. https://dx.doi.org/10.1021/acs.est.0c01285

- The NGEM research team is building a new VOC canister sampling system that can be remotely triggered by text message called the Remotely Operated Canister Sampler (ROCS). The sampling system will first be piloted in Carlsbad, New Mexico, as part of a regional research project with EPA Region 6 and the New Mexico Environment Department and the National Park Service. The goal of this project is to use the ROCS to understand how ozone precursors vary spatially and under different meteorological conditions and identify emission sources in New Mexico.